

Introduction to
**Regional Industry Cluster
Analysis**

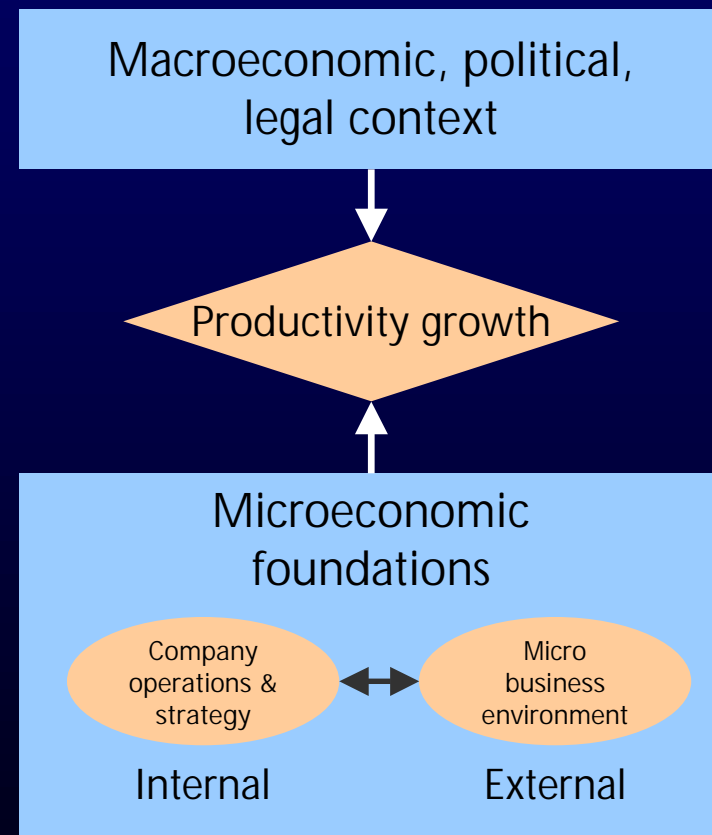
Edward J. Feser
Department of City & Regional Planning
University of North Carolina at Chapel Hill

Objectives

- What are industry clusters?
- What is industry cluster policy?
- What are some techniques for conducting industry cluster analyses?
- What can you gain from industry cluster analysis?
- Resources and guides

Introduction to industry cluster concepts

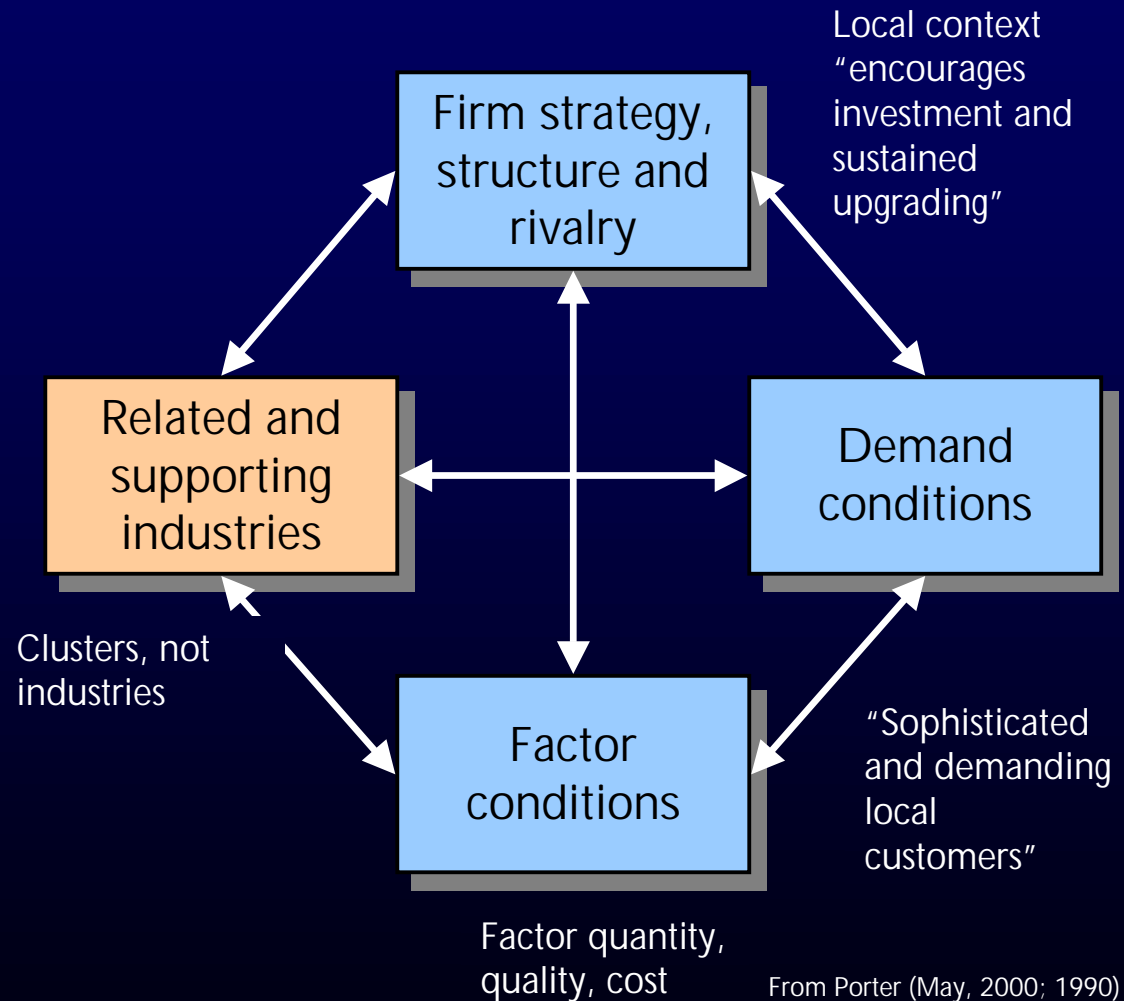
- Interest in clusters coincides with focus on competitiveness
- Erosion of traditional sources of comparative advantage
- Innovation as growth engine
- Michael Porter's framework



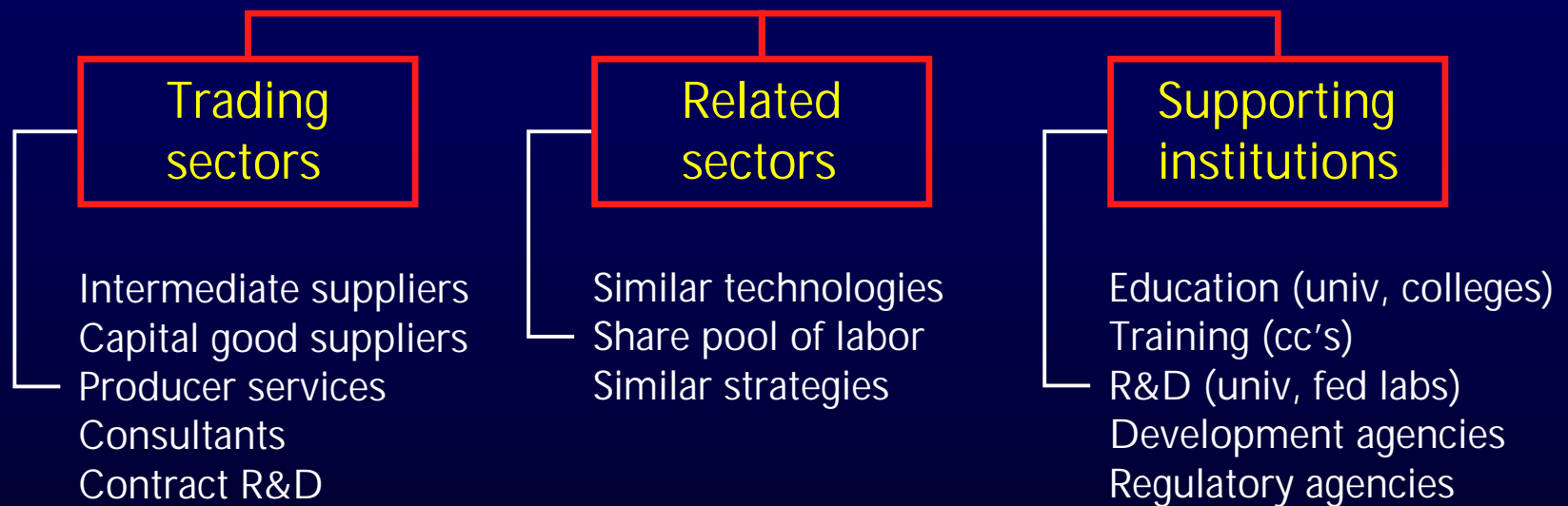
From Porter (May, 2000)

Porter's model of competitive advantage

- Four major determinants of competitive advantage
- Clusters as one element
- Clusters are not necessarily regional in scope
- Measurement unclear
- Limited verification



A cluster consists of interdependent firms and institutions:



- **Interdependence:** Each member firm's competitive position depends on one, some, or all other members of the group.

Why care about industry clusters?

Q: Why does success seem to breed success?

A: The benefits of being the first mover.

Q: What do growing knowledge-intensive and high tech sectors need to survive?

A: Opportunities and incentives to learn, create, upgrade.

Q: What do traditional sectors need to survive?

A: Same thing, as historical sources of advantage are ceded to overseas competitors.

Q: What are you overlooking with standard industry analysis alone?

A: Potential strengths, underlying weaknesses, latent opportunities, new ways of tackling old problems.

Q: What can you gain by targeting efforts?

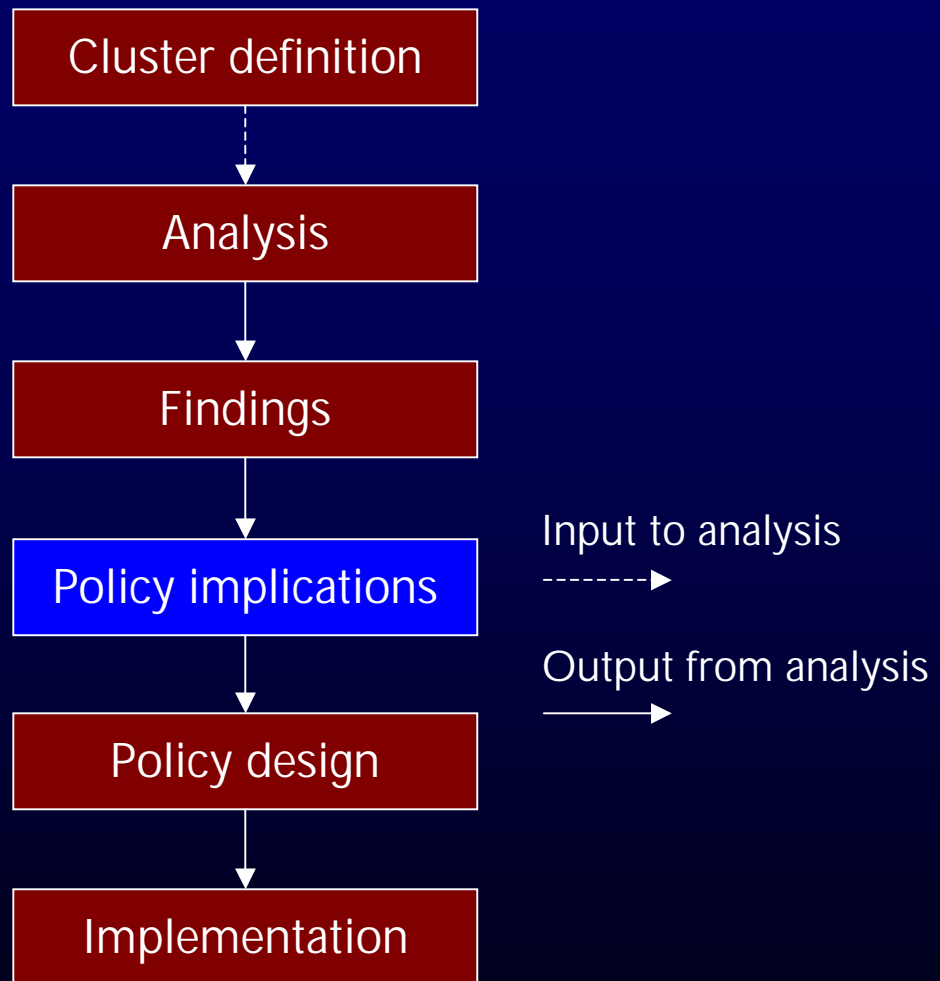
A: Efficient, effective use of scarce development resources.

Policy uses vary according to degree to which cluster concepts inform existing initiatives or serve as the basis for wholly new strategies.

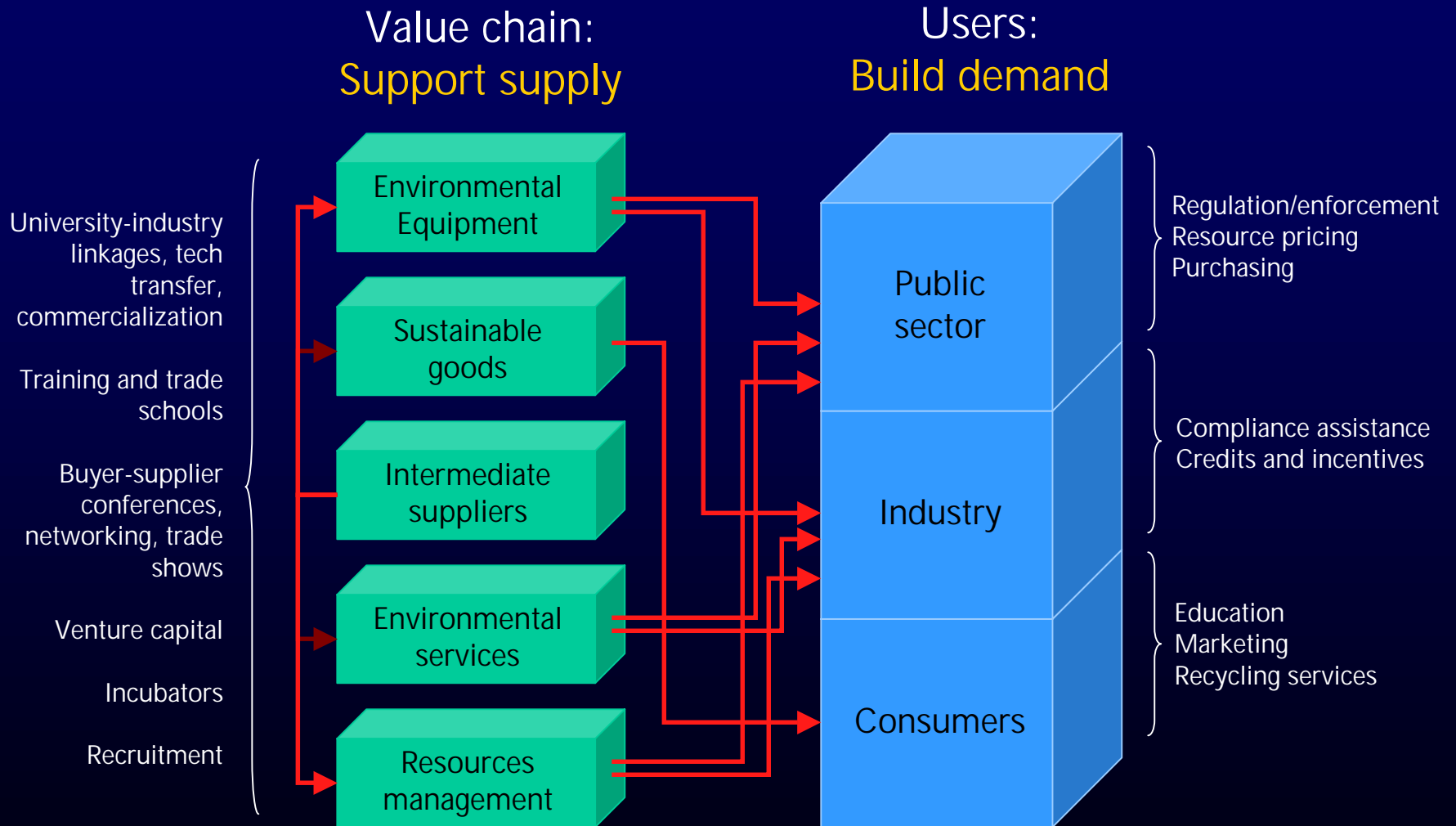
Degree of joint policy coordination
around cluster concept



The most common approach to cluster policymaking

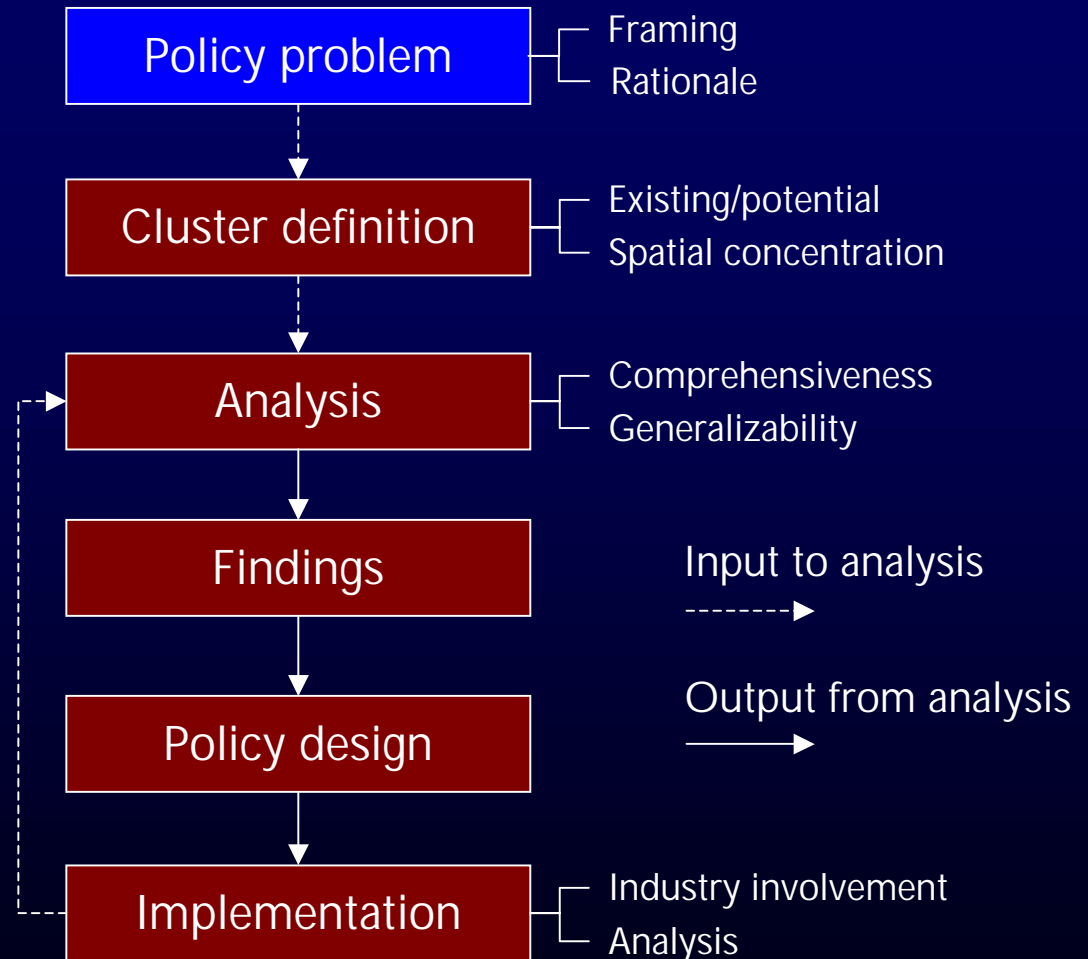


Example: Environmental technologies cluster



Arrow indicates trading linkage

Another approach to cluster policymaking



Typical policy needs imply two major types of applied cluster analyses

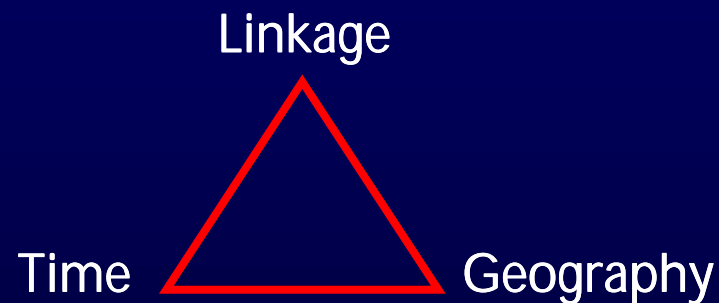
- General cluster analysis
 - Assessment of linkages and trends in all regional industries
 - Comprehensive and detailed
 - Application of generalized cluster definition or use of multiple definitions
- Focused cluster analysis
 - Investigation of one dimension of cluster concept -and/or-
 - Investigation of one or a few key industry segments

Conducting a cluster study: Challenges

- Relating concepts to measures
- Obtaining necessary data
- Applying data-intensive and complex analytical methods
- Interpreting findings
- Conveying findings

Begin by relating concepts to measures

Three dimensions of measurement:



- Linkage: Innovation, labor, inputs
- Geography: Localized, non-localized
- Time: Existing, declining, emerging or potential

Linkage dimension

- What binds the firms in the cluster together?
 - Value-chain clusters: *Firms that are members of the same extended value (product) chain*
 - Labor-based clusters: *Firms that share similar labor requirements (utilize a shared labor pool)*
 - Innovation clusters: *Firms that exchange key information, knowledge that leads to technological improvements or changes*

Geographic dimension

- Are member firms co-located in specific regions?
 - **Localized**: *Clusters in which firms are co-located in specific regions of state (or regions that span state borders)*
 - **Non-localized**: *Linked firms that are not localized in any particular region but exist across the state or that are concentrated in multiple regions*

Time dimension

- At what stage of development are identified “clusters” in?
 - **Existing:** *Clusters with significant presence and exemplify particular linkages that are the focus of study; usually presumes expansion*
 - **Declining:** *Existing clusters that are declining rather than expanding*
 - **Emerging:** *Clusters that appear to gaining a significant presence but haven't achieved a critical mass yet*
 - **Potential:** *Clusters that might emerge given trends, luck, or policy stimulation*

General Features of different methods

Method	Advantages	Pitfalls
Expert opinion	Easy Inexpensive Detailed contextual info	Not generalizable No matter how much you believe, it's still opinion
Specialization indicators (LQs)	Easy, inexpensive Can supplement methods	Focus is on sectors, not clusters
Input-output: Trade	Only major source of data on interdependence in U.S. Comprehensive and detailed	May be dated Industry definitions imperfect Neglects supporting institutions
Input-output: Innovation	Key measure of interdependence	Data not available in U.S. (see OECD activities)
Staffing patterns: Labor	Can be used to identify labor affinities	Occupation rather than skills based; fairly aggregate
Graph theory/ network analysis	Visualization aids interpretation and analysis	Methods, software still limited
Surveys	Flexibility to collect ideal data; current	Costly Difficult to implement properly

Framing helps determine approach

Identify and frame the policy problem first, i.e., KNOW WHAT YOU WANT

Policy problem:
What will you use the study for?

Determines:

Cluster definition

Existing?
Potential or emerging?
Spatial or non-spatial?
Type of linkage?

Methodology

Comprehensive?
Generalizable?
Qualitative?
Quantitative?

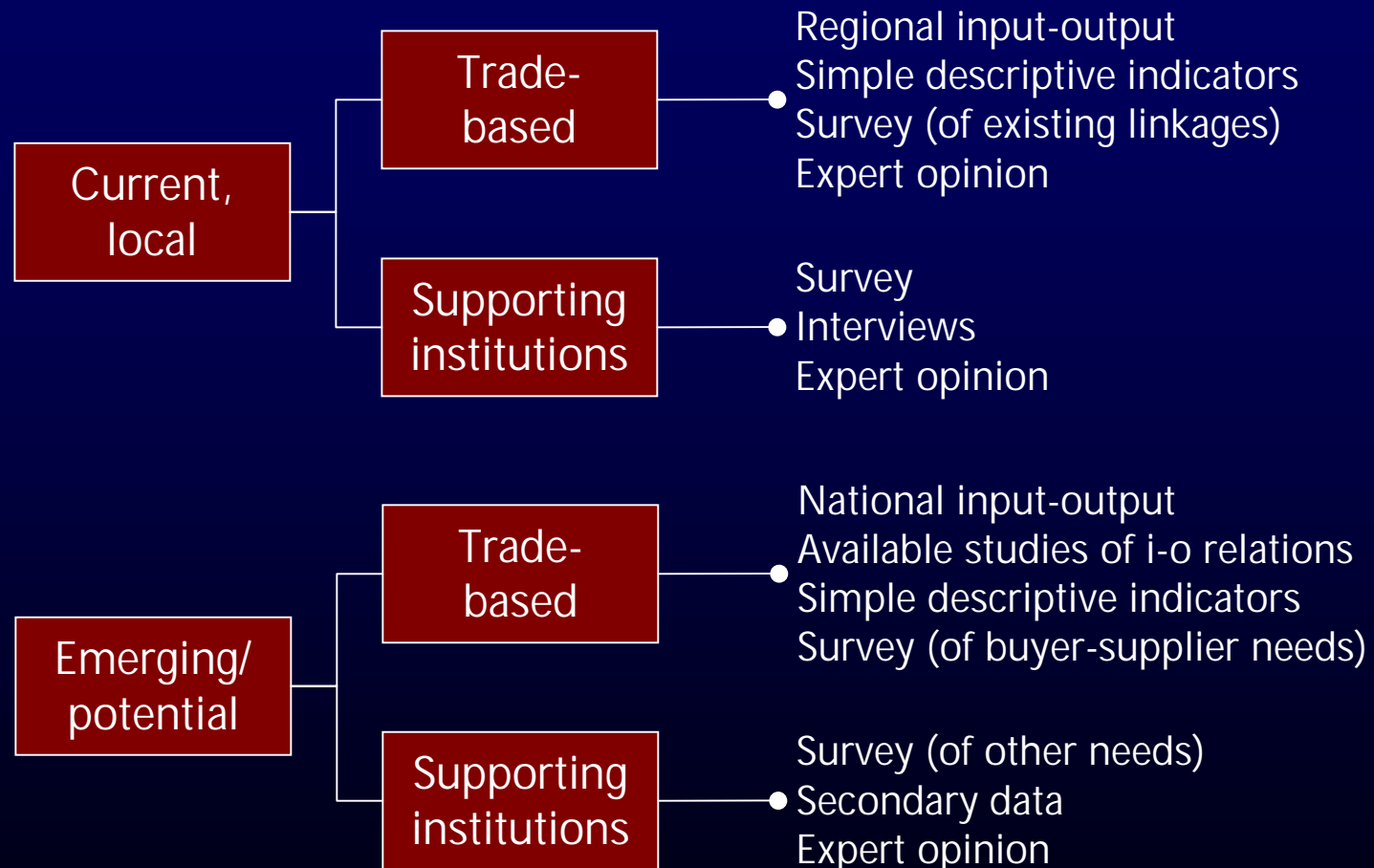
Implementation

Industry buy-in?
Analysis only?
Marketing only?

FOCUS on value-chain and labor clusters

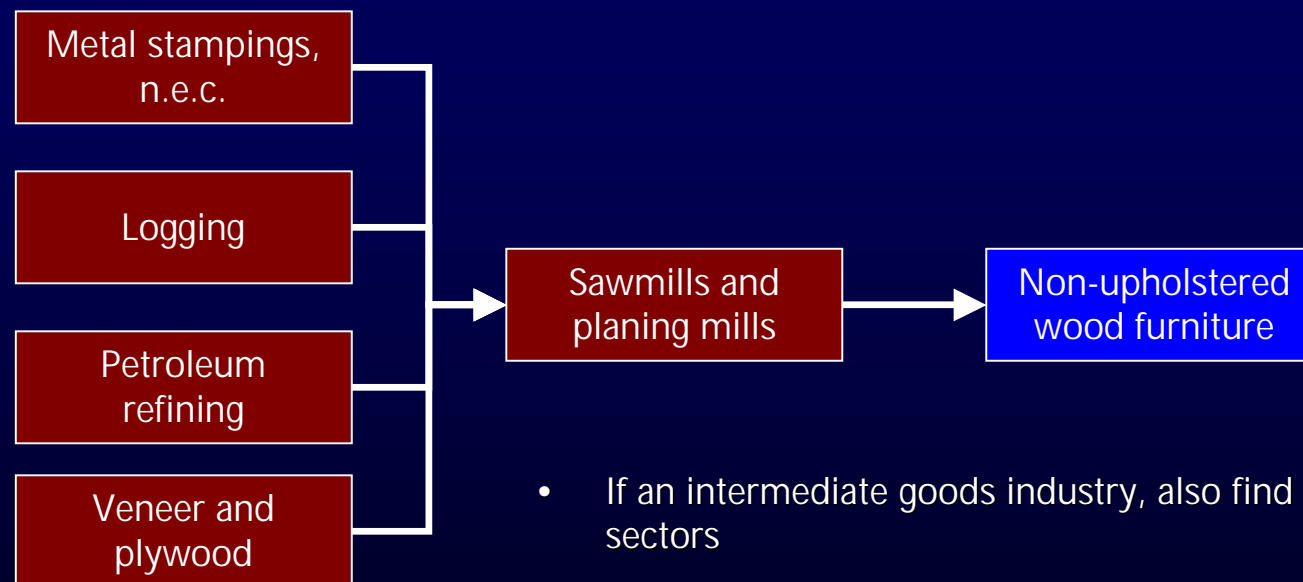
- No applicable data to identify innovation-based clusters
- Value-chain and labor based clusters can provide good first approximation to innovation-based clusters
- Qualitative methods can be used to identify innovation linkages within VC or labor clusters

Value-chain clusters: Identify interdependencies



Two methods of VC cluster analysis

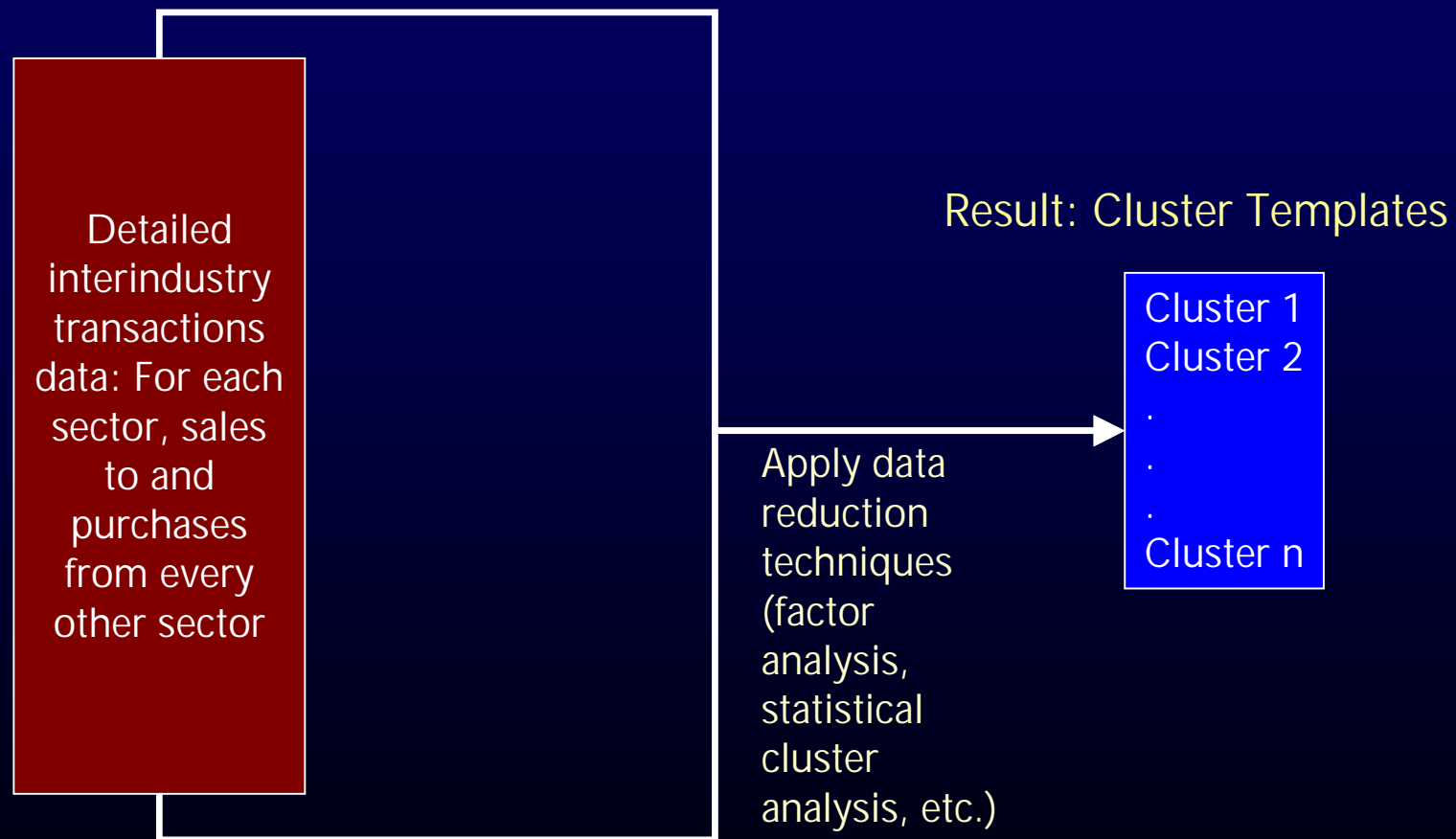
Bottom-up method: Identify value chain for a single sector by finding key first, second, third tier suppliers



- If an intermediate goods industry, also find key buying sectors
- Regional input-output approximates local trading patterns
- National input-output approximates potential trading patterns
- Use other methods to identify related sectors and supporting institutions

Two methods of VC cluster analysis

Top-down method: Identify an exhaustive set of industry clusters through comprehensive analysis of interdependence between all sectors



Benchmark U.S. manufacturing clusters



Features of benchmark clusters

- Amounts to value chain-based rather than product-based manufacturing classification system
- 3- and 4-digit SIC industries may be members of multiple clusters
- Each cluster includes direct and indirect trading partners
- Includes measure of strength of linkage between component sector and broader cluster
- Reasonable initial estimate of interdependent industries even where trading links don't exist
- Can be easily combined with qualitative cluster analysis methods

Cluster	No. of Sectors	2-Digit SIC Sectors
Metalworking	116	10
Vehicle Manufacturing	58	16
Chemicals & Rubber	48	14
Electronics & Computers	38	8
Packaged Foods	44	5
Printing & Publishing	32	8
Wood Products	23	6
Knitted Goods	23	5
Fabricated Textile Products	22	9
Nonferrous Metals	14	4
Canned & Bottled Goods	12	2
Leather Goods	9	1
Aerospace	10	6
Feed Products	10	2
Platemaking & Typesetting	14	7
Aluminum	9	4
Brake Products	9	4
Concrete, Cement, & Brick	8	2
Earthenware Products	8	1
Tobacco Products	4	1
Dairy Products	6	1

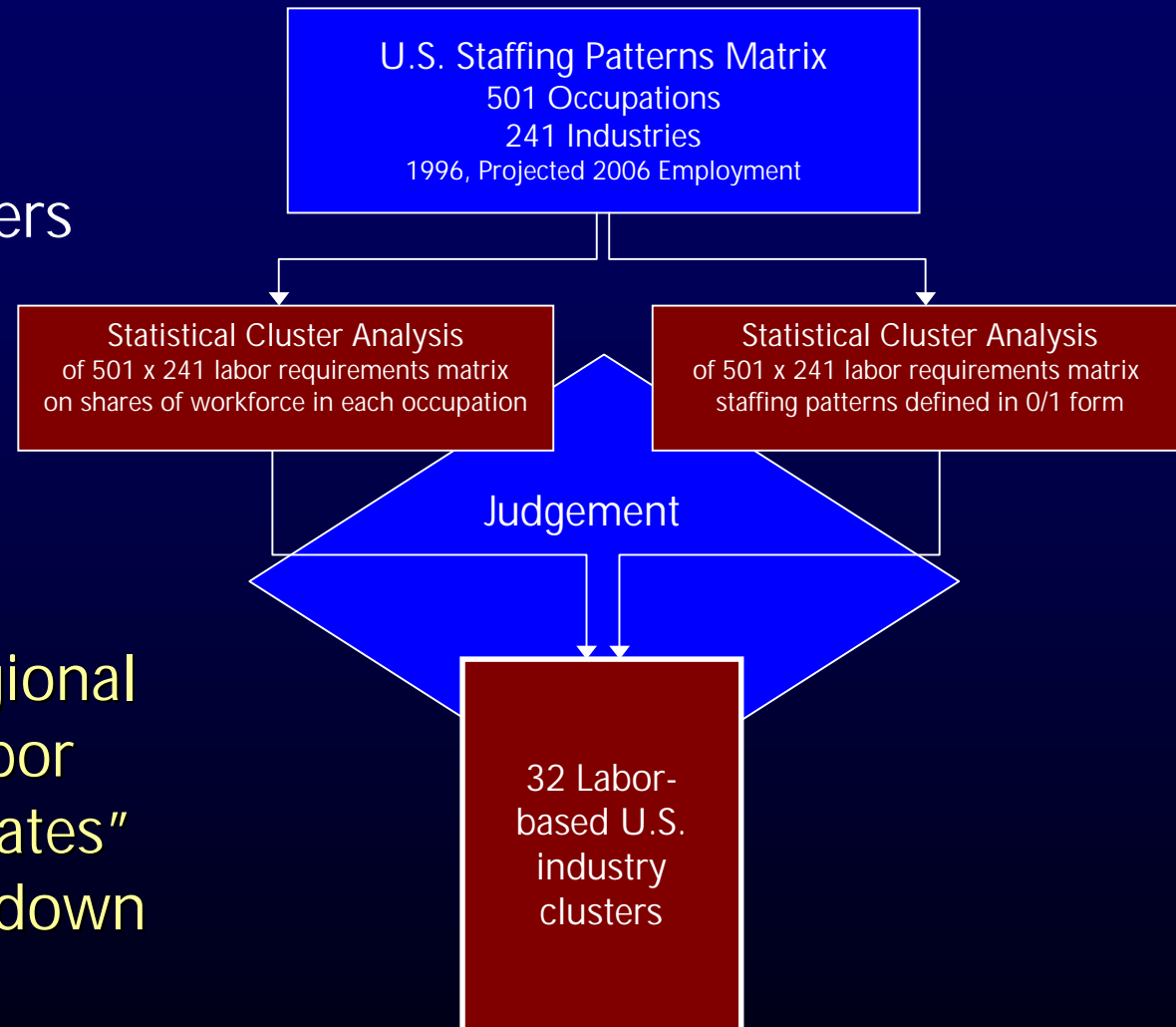
Aerospace: illustration of a value-chain

Input output code	SIC sector	Description	Load ing	Cluster ID		
				L1	L2	L3
600200	3724, 3764	Aircraft and missile engines and engine parts	.92	13		
600100	3721	Aircraft	.90	13		4
130100	3761	Guided missiles and space vehicles	.82	13		
600400	3728, 3769	Aircraft and missile equipment, n.e.c.	.70	13	4	
380900	3356	Nonferrous rolling and drawing, n.e.c.	.69	13	10	16,1
381400 (s)	3463	Nonferrous forgings	.59	13		
430100 (s)	3511	Turbines and turbine generator sets	.58	1	13	
381300 (s)	3364, 3369	Nonferrous castings, n.e.c.	.56	10	13	13
620101 (s)	381	Search and navigation equipment	.41	4		13
560500 (s)	3663, 3669	Communication equipment	.36	4		

(s) indicates secondary sector

- Loading indicates strength of linkage between sector and cluster
- Column labeled 'cluster ID' indicates codes for other clusters in which sector is a member
- Secondary sectors are those only moderately tied to the cluster

Methods: Analysis with Labor-Based Industry Clusters



Analysis of regional trends with labor cluster "templates" similar to top-down VC approach

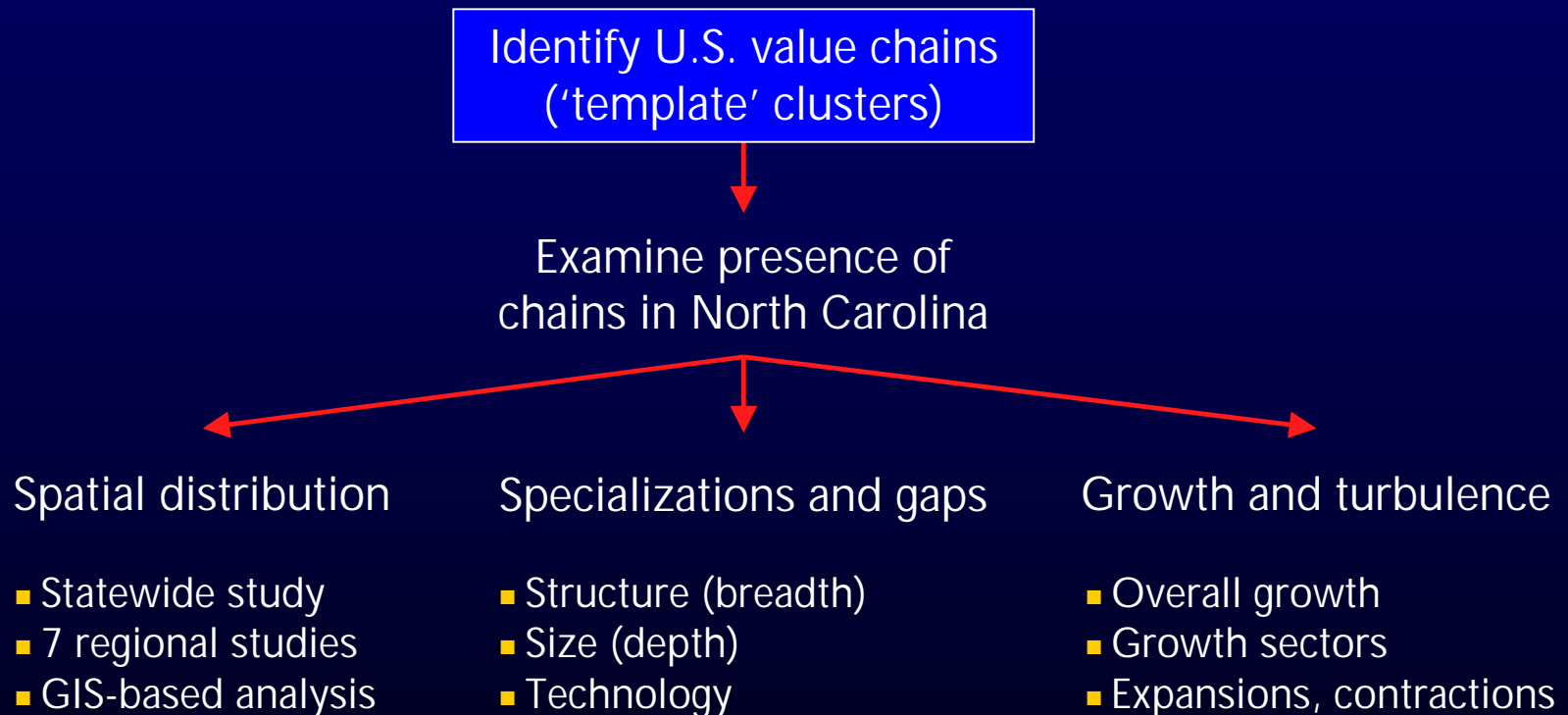
Illustration I: North Carolina cluster project

- Policy need:
- Economic rationale:
- Cluster definition:
- Methodology:
- Implementation:
- Target technology adoption programs more effectively
- Technologies diffuse through value chain, focused analysis
- Potential and emerging clusters, value-chain based
- Input-output based, top down approach
- Primarily analysis, planning for manufacturing sector

Illustration II: Scranton/Wilkes-Barre

- Policy need:
 - Economic rationale:
 - Cluster definition:
 - Methodology:
 - Implementation:
- Develop a strategic plan for technology-related development
 - No *a priori* rationale based on policy need, general analysis
 - Existing, emerging and potential, value-chain, labor
 - Bottom-up input-output, labor cluster analysis
 - Primarily analysis to inform planning efforts

North Carolina project scope

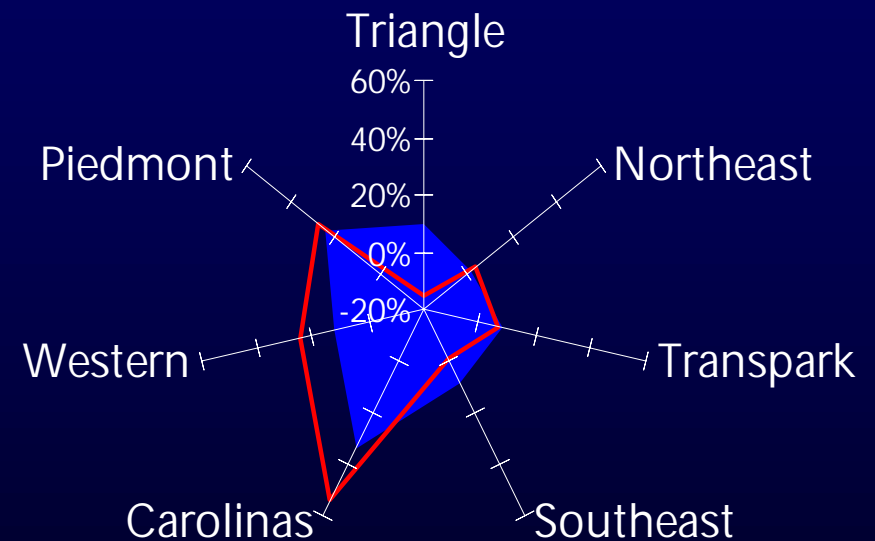


What can be done with national-level value chains at the state or regional level?

- Look for relative presence of each chain in the state or region
- Look for components of the chain present
- Determine why some elements of the chain are missing
- Determine why other elements are present
- Combine with other methods (surveys, regional input-output) to examine regional trading patterns
- Do not assume regional economy should parallel national economy, but do use templates to better understand your current industry mix
- Chains may serve as the basis for identifying the challenges and opportunities facing the region's industry

Vehicle manufacturing an NC strength revealed by top-down cluster analysis

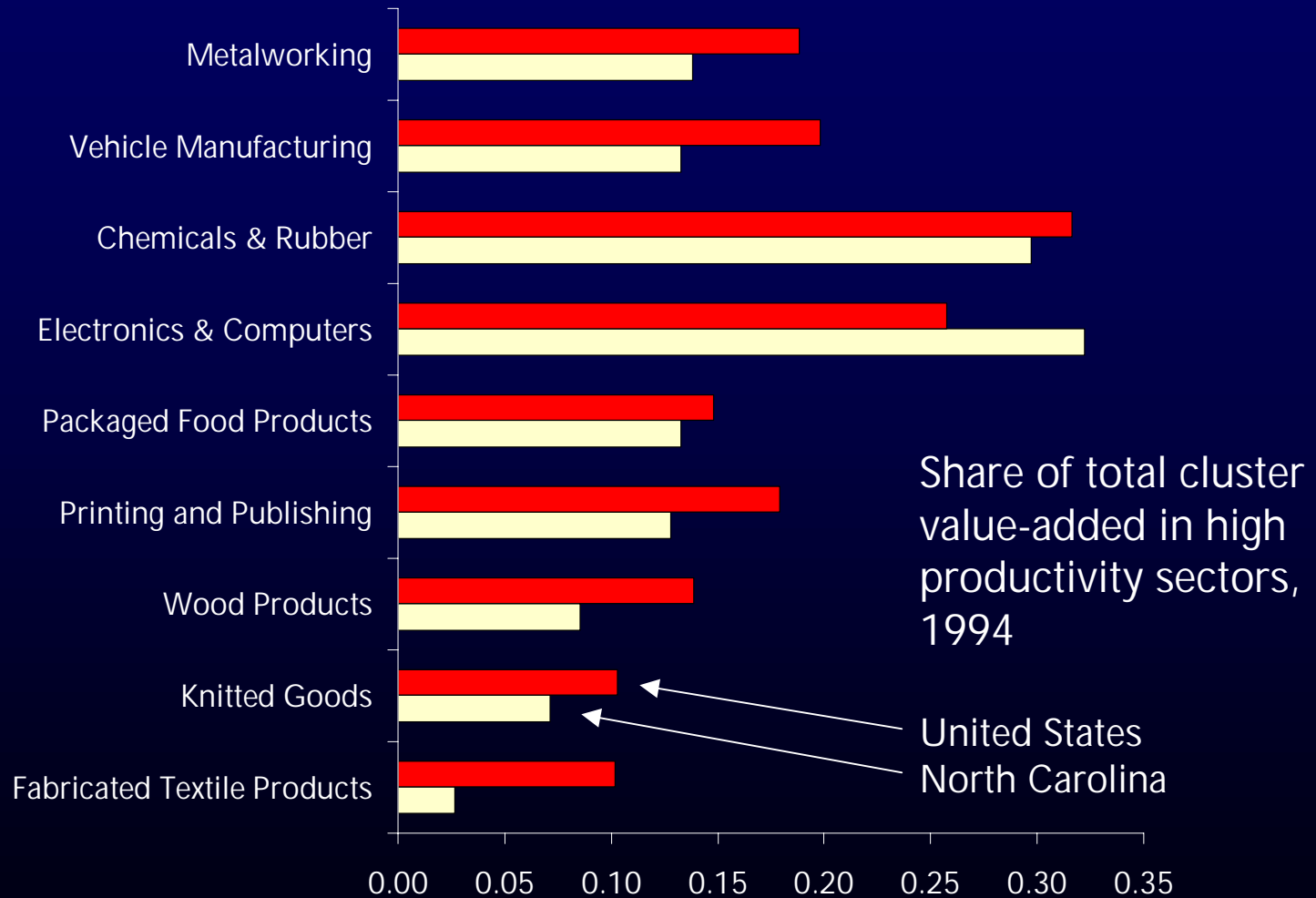
- SIC 37, transportation equipment industry accounts for 2.5 percent of state value-added and 3 percent of employment
- The vehicle manufacturing cluster is the second-largest in the state
- Growth of the cluster is most pronounced in central and western parts of the state
- Pattern and nature of cluster growth is consistent with national southward shift of auto production



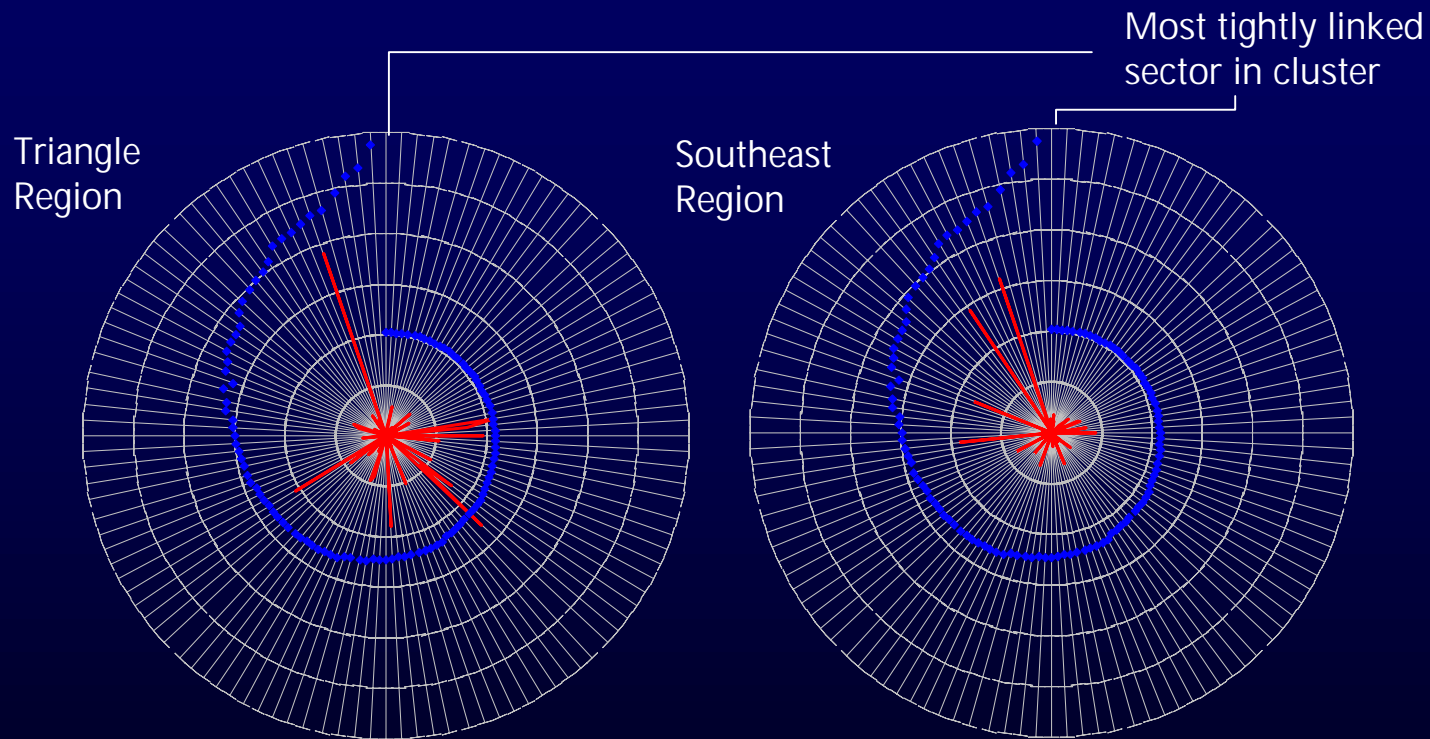
Area: Regional shares of statewide vehicle manufacturing cluster employment, 1989

Outline: Regional shares of statewide VF cluster employment growth, 1989-1994

North Carolina value-chains specialized in lower-productivity, lower wage sectors



Metalworking linkages likely tighter in Triangle than Southeast region



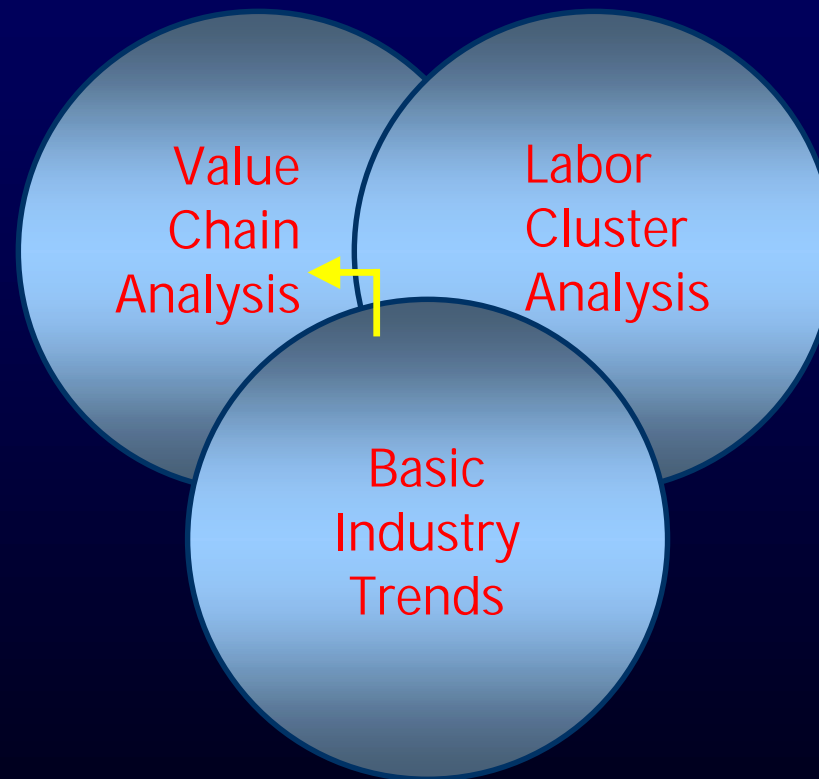
Length of line from origin indicates number of employees in given sector; Axis dimensions range from 0 (at center) to 3,000 at edge.

← Axes are sectors that make up the cluster, ordered clockwise by the strength of the linkage between the sector and overall cluster.

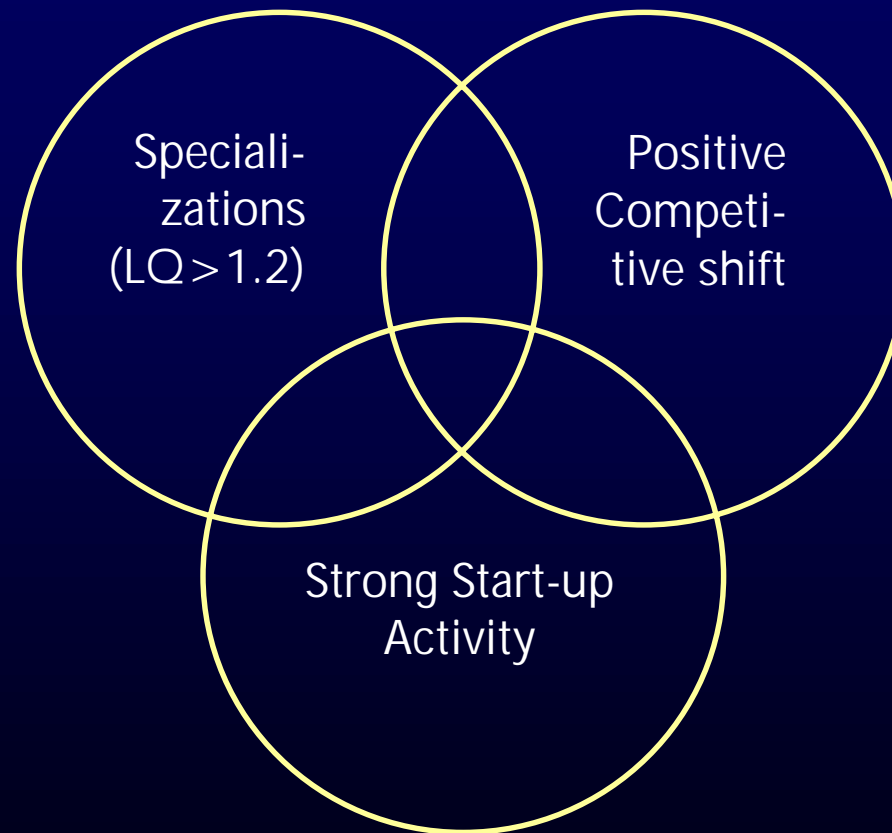
Scranton/Wilkes-Barre project scope

- Identify key sources of industrial growth during 1990s
 - Specializations
 - High growth sectors relative to the U.S., controlling for national trends
 - Start-up activity
- Identify groups of industries (industry clusters) whose members a strong degree of potential interdependence and shared competitiveness
- Identify any emerging industries that could take advantage of existing up- and downstream industrial activity
- Identify supplier and purchasing sectors that might constitute viable development targets
- Focus on higher value, higher technology sectors

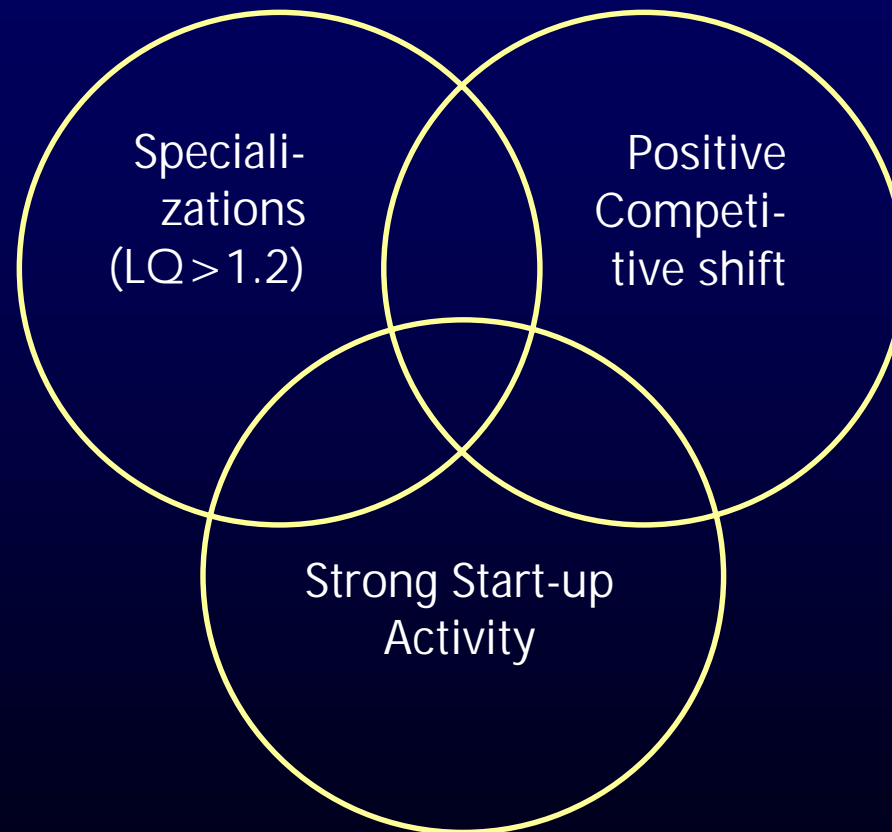
Study Developed overlapping evidence



Step 1: Basic Industry Analysis



Step 2: Labor cluster analysis



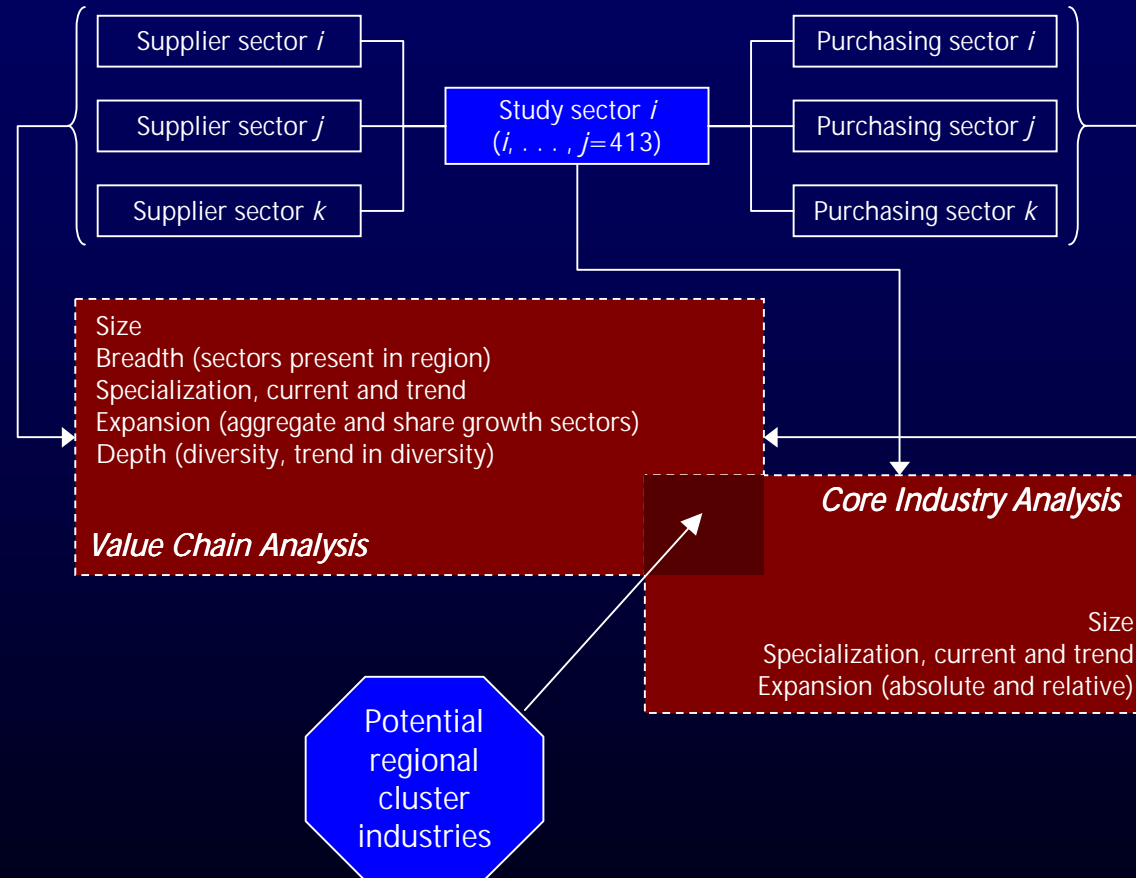
Step 3: Bottom up cluster analysis

1. Identification of 1st and 2nd tier supplier and purchasing chains for each of 413 basic industries

2. Examination of characteristics of each chain

3. Identification of core regional industries

4. Reduced Set of regional industries with strong or emerging potential up- and/or downstream linkages



Step 4: Interpret overlapping evidence

- Look for consistent results across analyses: VC clusters should overlap with labor clusters
- Weakness of approach
 - Interpretation involves considerable 'art'
- Strength of approach
 - The notion of a single set of "clusters" for a give region unreasonable except at the most aggregate level
 - Provides a level of detail that can facilitate strategic planning
 - Can serve as a framework for continuous monitoring

Summary thoughts

- Think policy needs first
- Identify appropriate clustering dimension to focus on
- Are localized clusters what you're after?
- Existing, emerging, potential?
- Utilize existing studies (e.g., "templates"), at least as a start
- If you commission a study, demand the following:
 - Full and detailed disclosure of all methods and data
 - An actual assessment of interdependence, not just specialization
 - Follow-up interpretation and support

Available guides

"Old and New Theories of Industry Clusters," by E. Feser. In *Clusters and Regional Specialisation: On Geography, Technology, and Networks*, edited by M. Steiner, Pion Ltd., 1998.
(www.pion.co.uk/ep/errs/errs1st.html)

"Industry Clusters: a Methodology and Framework for Regional Development Policy in the U.S.," by E. Bergman and E. Feser, Forthcoming in *Cluster Analysis and Cluster Based Policy: New Perspectives and Rationale in Innovation Policymaking*, edited by T. Roelandt and P. den Hertog. Paris: OECD, 1999.

"National industry cluster templates: A framework for applied regional cluster analysis," by E. Feser and E. Bergman, Forthcoming *Regional Studies*, 1999. (Contains all data in this presentation.)

Industry Clusters: An Internet Resource for Economic Developers, by J. LeVeen, 1998.
(www.unc.edu/depts/dcrpweb/courses/261/leven/index.html)

Targeting North Carolina Manufacturing: Understanding the State's Economy through Industrial Cluster Analysis, by E. Bergman, E. Feser, and S. Sweeney, North Carolina Alliance for Competitive Technologies, 1996. (Contains set of U.S. manufacturing value chains based on 1987 input-output accounts.)

Industrial Strength Strategies: Regional Business Clusters and Public Policy, by S. Rosenfeld, Aspen Institute, 1995.

The Competitive Advantage of Nations, by M. Porter, Basic Books, 1990.